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Stichopogon ariasi sp. nov., an undescribed species of the genus *Stichopogon* Loew, 1847 from Spain (Diptera: Asilidae)

Stichopogon ariasi, sp. nov., una especie sin describir del género *Stichopogon* Loew, 1847, de España (Diptera: Asilidae)

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ABSTRACT: *Stichopogon ariasi* sp. nov. is a new species of the genus *Stichopogon* Loew, 1847 discovered in Spain. The differences between it and other related species are discussed. An identification key for the species of the genus *Stichopogon* found on the Iberian Peninsula is also provided for the first time.
KEY WORDS: *Stichopogon*, Asilidae, Diptera, new species, Spain, Iberian Peninsula.

RESUMEN: *Stichopogon ariasi* sp. nov. es una especie nueva del género *Stichopogon* Loew, 1847, descubierta en España. Se comentan las diferencias con otras especies relacionadas. Así mismo, se proporciona por primera vez una clave para la identificación de las especies del género *Stichopogon* presentes en la Península Ibérica.
PALABRAS CLAVE: *Stichopogon*, Asilidae, Diptera, especie nueva, España, Península Ibérica.

Introduction

Robber flies (Asilidae) are an exclusively predaceous family of flies, easily recognizable by their elongated bodies, by the presence of a forward-facing, strongly chitinized proboscis, and by a tuft of bristly hairs, called the mystax, which is found over the mouth (MARSHALL, 2012).

Within the members of the Asilidae, the subfamily Stichopogoninae (sensu DIKOW, 2009) are rather small (3-12 mm) and are generally dwellers of open sandy or rocky surfaces (MARSHALL, 2012). This subfamily can be recognised by the divergent eye margins above the antennae and, in lateral view, the distinctly sinuate posterior eye margin in the lower half (DIKOW, 2009). In Spain, the subfamily is represented by three genera: *Lasiopogon* Loew, 1847, *Rhadinus* Loew, 1856 and *Stichopogon* Loew, 1847. *Stichopogon* can be separated from *Lasiopogon* by its considerably smaller size, the absence of a prominent facial gibbosity, and the absence of long strong dorsocentral bristles on the mesonotum. Although similar in shape and size to *Rhadinus*, *Stichopogon* can be easily separated by the presence of pulvilli on the tarsi, which are absent in *Rhadinus*, and by the mystax, which is always confined to the lower part of the face in *Stichopogon*, while almost reaching up to the antennae in *Rhadinus* (ENGEL, 1930).

Species of *Stichopogon* are present on all continents with the exception of Antarctica (HULL, 1962). All species are rather small dark flies, 3-8 mm long, with patterns of light coloured tomentum on thorax and abdomen. The antennae are situated approximately half way up the height of the eye. The face is shorter than frons or almost as long. The mystax is found on the lower third of the face and usually consists of hair-like setae; in some species these setae can be more bristle like (ENGEL, 1930; EFFLATOUN BEY, 1937).

Fifteen taxa of *Stichopogon* are known for Europe, of which six species are present in peninsular Spain to date (PORTILLO *et al*., 2002; CARLES-TOLRÁ, 2018; ÁLVAREZ FIDALGO & VAN DEN BROEK, 2019): *Stichopogon albofasciatus* (Meigen, 1820), *Stichopogon elegantulus* (Wiedemann *in* Meigen, 1820), *Stichopogon inaequalis* Loew, 1847, *Stichopogon pusio* (Macquart, 1849), *Stichopogon scaliger* Loew, 1847 and *Stichopogon schineri* Koch, 1872.

In May 2013, the first author photographed a *Stichopogon* species near a riverbank in Fresno de Torote (province of Madrid). Using the key by ENGEL (1930), the species keyed out to *Stichopogon beckeri* Bezzi, 1910. However, as this species is only known from Egypt (BEZZI, 1910; ENGEL, 1930; EFFLATOUN BEY, 1937), the United Arab Emirates (BOSÁK *et al.*, 2014) and Cape Verde (FREY, 1958; ABU EL-HASSAN *et al*., 2017), the authors were cautious and decided that further research was needed.

In an attempt to identify the specimen, the first author checked all *Stichopogon* specimens present in MNCN, Madrid. Special attention was given to those of the similar species *S. albofasciatus*. Eleven specimens of this taxon are present in the collection, and also nine additional ones that were labelled as a "variety" of *S. albofasciatus* (identified by Gil Collado) bearing a white mystax, which were extremely similar to the specimen photographed. These nine specimens were studied closely, and it could be concluded that these were not a mere variety of *S. albofasciatus* but actually either *S. beckeri* (the only known species with a description close to that of the specimens from Madrid) or an undescribed species.

Recently, two series of specimens were collected in Talavera la Nueva (province of Toledo, Autonomous Community of Castilla-La Mancha) in 2016 and 2017, and a few more were collected in Villafranca del Castillo and Aldea del Fresno (province of Madrid) in 2018, all identical to those identified as a variety of *S. albofasciatus* by Gil Collado. In order to reach a conclusion, a specimen of *S. beckeri* was borrowed from MNB and, after its examination, it was concluded that the specimen found in Fresno de Torote, the series labeled as 'variety' of *S. albofasciatus* in MNCN, and the freshly collected specimens, all belong to an undescribed species. The new species, named *Stichopogon ariasi*, becomes the seventh species of *Stichopogon* present in Spain and on the Iberian Peninsula.

Material and methods

The terminology used for the body parts follows GELLER-GRIMM (2005).

The acronyms for collections of museums and institutes and abbreviations for private collections used in this paper are:

MNB = Museum für Naturkunde, Berlin
MNCN = Museo Nacional de Ciencias Naturales, Madrid
PAF = Piluca Álvarez Fidalgo, private collection, Madrid, Spain
RVDB = Reinoud van den Broek, private collection, Tilburg, The Netherlands
UCME = Museo de Entomología de la Universidad Complutense, Madrid

The recently collected material was compared with similar specimens present in the collections of MNCN and UCME, a male specimen of *S. beckeri* borrowed from MNB, and specimens of *S. albofasciatus* present in the collection of MNCN, three of which were collected in Austria. Table 1 shows all of the material studied.

***Stichopogon ariasi* sp. nov.**					
Collector/Collection	**Record date**	**Nr. and sex**	**Locality**	**Province**	**UTM**
ARIAS, J. / MNCN	11-VI-1905	2♂+4♀	El Pardo	Madrid	30TVK38
ARIAS, J. / MNCN	17-VI-1906	1♂+1♀	El Pardo	Madrid	30TVK38
ARIAS, J. / MNCN	22-VI-1906	1♂	El Pardo	Madrid	30TVK38

PERIS, S. V. / UCME	27-V-1962	1♀	Torrejón de Ardoz	Madrid	30TVK67
ÁLVAREZ, P. / MNCN	3-VI-2015	1♂	Villafranca del Castillo	Madrid	30TVK17
ÁLVAREZ, P. / RVDB	5-VI-2016	2♂+3♀	Talavera la Nueva	Toledo	30SUK32
ÁLVAREZ, P. / MNCN	23-V-2017	1♂+1♀	Talavera la Nueva	Toledo	30SUK32
PASCUAL, J. I. / PAF	20-V-2018	1♂+1♀	Aldea del Fresno	Madrid	30TUK96
ÁLVAREZ, P. / MNCN	12-VI-2018	1♂+1♀	Villafranca del Castillo	Madrid	30TVK17
***Stichopogon albofasciatus* (Meigen, 1820)**					
Collector/Collection	**Record date**	**Nr. and sex**	**Locality**	**Country**	**UTM**
STROBL, X. / MNCN	----	2♂+1♀	----	Austria	----
***Stichopogon beckeri* Bezzi, 1910**					
Collector/Collection	**Record date**	**Nr. and sex**	**Locality**	**Country**	**UTM**
---- / MNB	----	1♂	Alexandria	Egypt	----

Table 1: Data compilation of specimens of *Stichopogon* Loew, 1847 studied in this work. Specimens of each species are listed according to record dates.

The genitalia of the new species were first separated from the abdomen and macerated for 24 hours in a cold solution of approximately 20% KOH. Then they were dissected and prepared on glycerine to be photographed. The high resolution photographs of the genitalia, holotype and paratypes of *S. ariasi*, the specimen of *S. beckeri* and specimens of *S. albofasciatus* were taken using a Nikon D810 camera equipped with a Cnscope 4X Achromatic Microscope Objective Lens with extension tube; focal depth has been enhanced by stacking several images, using the software programs Zerene Stacker 1.04 and Adobe Photoshop CC 2015. The preliminary study of most specimens was performed with an Olympus X-Tr microscope. The general measurements and morphological analyses and diagnoses of the types were performed using a Leica M80 binocular microscope.

The maps were created in the software program QGIS 3.4.

Results

S. albofasciatus, *S. beckeri,* the recently collected specimens of a *Stichopogon* sp., and those labelled as a variety of *S. albofasciatus* in the MNCN with a white mystax, all share a typical pattern of greyish white tomentum on tergites 1, 4, 5, and the last tergite, and black legs with greyish white tomentum. The comparative study of all of the specimens mentioned in Table 1 shows that the recently collected specimens of a *Stichopogon* sp. and those labelled as a variety of *S. albofasciatus* in the MNCN with a white mystax all belong to a clear and separate, previously undescribed species. Morphologically the new species can be rather easily separated from the similar species *S. albofasciatus* and *S. beckeri*. Table 2 shows several differences between the three species.

The male genitalia could only be compared with the drawings of *S. albofasciatus* in THEODOR (1976) as no material of this species was available for dissection. Most notable similarities and differences can be found in the shape of the epandrium and proctiger, and make clear that both species are closely related yet different. The epandrium of both species has long apical processes with lateral rows of spines. In *S. albofasciatus*, it has a deep incision in the middle which is only shallow in *S. ariasi.* Also the new species has long basal processes in the epandrium (Fig. 7), which seem to be absent in *S. albofasciatus* (THEODOR, 1976).

	***Stichopogon ariasi* sp. nov.**	***Stichopogon albofasciatus***	***Stichopogon beckeri***
Mystax (♂+♀) **(Figs. 1, 2a-d)**	white; several rows of hair-like setae, clinging together above the mouth margin	black; several rows of bristles not clinging together	white; hair like setae, placed fanwise above mouth margin.

Facial gibbosity (♂+♀) **(Fig. 1)**	slightly higher, and rounder in the lower part	slightly lower, and pointier in the lower part	rounder and less prominent
Pubescence on mesonotum **(Fig. 2a-b)**	short, white adpressed	short, black adpressed	longer, white, semi erect.
Colour of thoracic bristles (♂+♀)	white	black	white
Bristles on sternites 5-6 (S5-S6) (♂) **(Fig. 2e-f)**	adpressed white bristles located laterally on S5 and S6 and bent towards the center from both sides of the sternites	dense and long, mainly erect black bristles on most of the surface of S5 (which stand out from the border of S5 in lateral view), absent on S6	very short inconspicuous adpressed white pubescence
Shape of epandrium (♂ genitalia) **(Fig. 7)**	the epandrium has long apical projections with lateral rows of spines, a shallow incision in the middle and two long basal projections.	also with long apical projections with a lateral row of spines, a deep incision in the middle and basal projections absent	No available material or illustrations
Bundle of dense yellowish hairs on the ventral surface of the lamellae (♀ genitalia) **(Fig. 3)**	long, protruding and thickly set together; their apices curl inwards and touch	similarly built, but shorter, not so much curled, and their apices not touching	similarly built but shorter than in *S. ariasi*
Size (♂+♀)	Average bigger (7-9 mm)	Average smaller (6-8 mm)	Small (5-6 mm)
Flight period (♂+♀)	early May to late June	middle July to late August	spring species, mainly collected in May (?)

Table 2: Differences between *Stichopogon ariasi* sp. nov., *Stichopogon albofasciatus* (Meigen, 1820), and *Stichopogon beckeri* Bezzi, 1910.

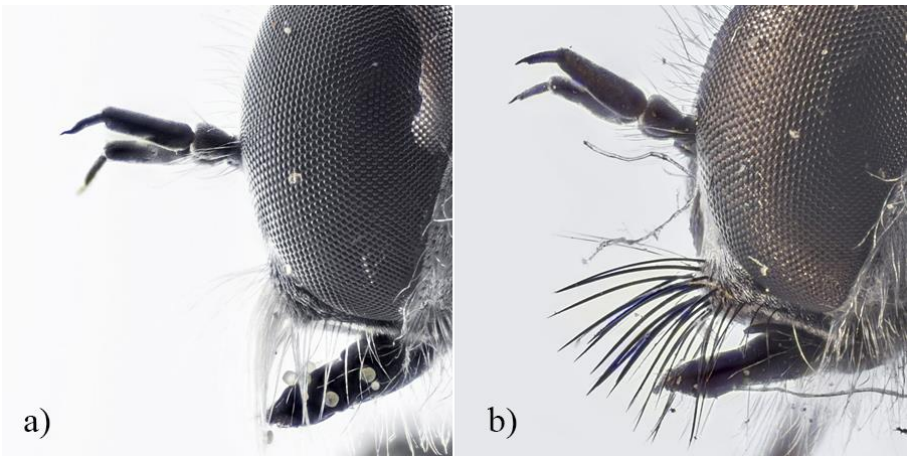

Fig. 1: Mystax in lateral view: a) *Stichopogon ariasi* sp. nov. Male paratype (MNCN_Ent 231294), Villafranca del Castillo, Madrid, 12-VI-2018; b) *Stichopogon albofasciatus* (Meigen, 1820). Male (MNCN_Ent 208158), Austria (location and date unknown). (Photos: Alberto Narro Martín)

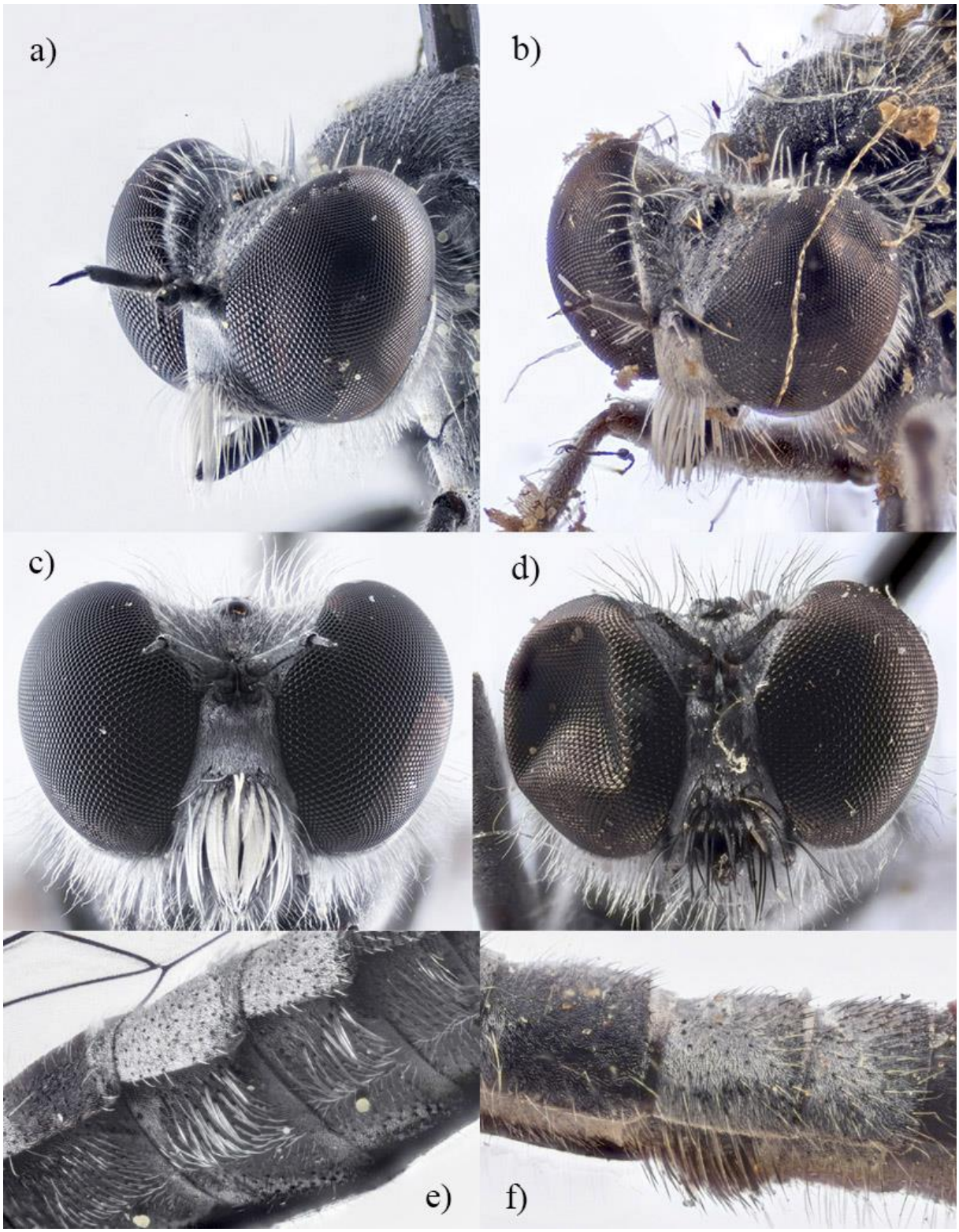

Fig. 2: Mystax and hairs on mesonotum: a) *Stichopogon ariasi* sp. nov. Female paratype (MNCN_Ent 231295), Villafranca del Castillo, Madrid, 12-VI-2018; b) *Stichopogon beckeri* Bezzi, 1910. Male, Alexandria (date unknown), specimen courtesy of MNB. Mystax in frontal view: c) *Stichopogon ariasi* sp. nov. Male paratype (MNCN_Ent 231294), Villafranca del Castillo, Madrid, 12-VI-2018; d) *Stichopogon albofasciatus* (Meigen, 1820). Male (MNCN_Ent 208158), Austria (location and date unknown). Fifth and sixth sternites: e) *Stichopogon ariasi* sp. nov. Male paratype (MNCN_Ent 231294), Villafranca del Castillo, Madrid, 12-VI-2018; f) *Stichopogon albofasciatus* (Meigen, 1820). Male (MNCN_Ent 208158), Austria (location and date unknown). (Photos: Alberto Narro Martín)

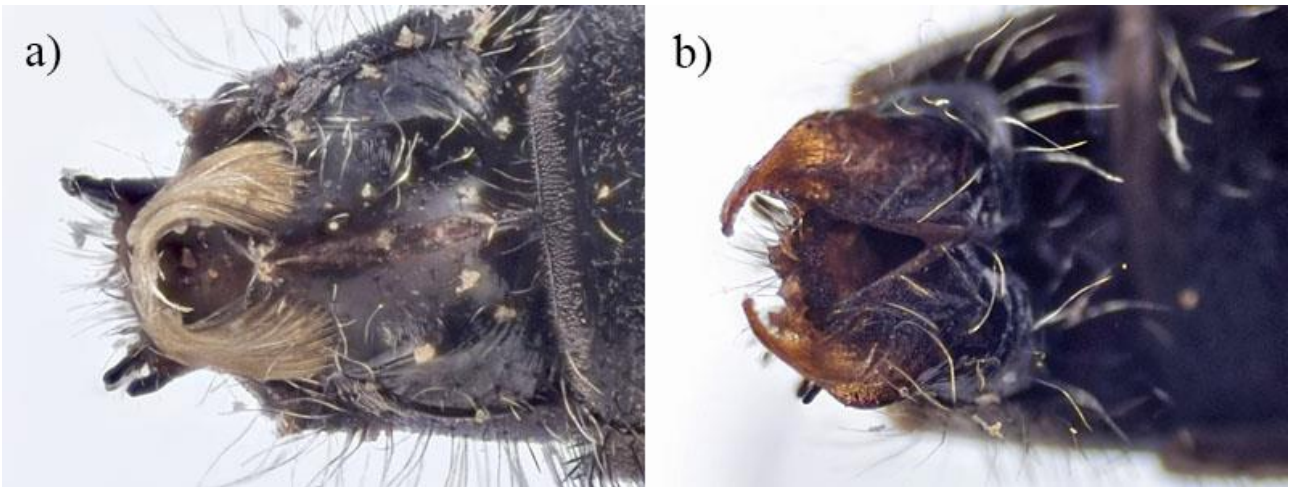

Fig. 3: Bundle of hairs on ventral lamellae of female: a) *Stichopogon ariasi* sp. nov. Paratype (MNCN_Ent 231295), Villafranca del Castillo, Madrid, 12-VI-2018; b) *Stichopogon albofasciatus* (Meigen, 1820). Female (MNCN_Ent 208160), Austria (location and date unknown). (Photos: Alberto Narro Martín)

Taxonomic accounts

A new species of *Stichopogon* is studied and photographed in high resolution.

Order Diptera Linnaeus, 1758
Superfamily Asiloidea Latreille, 1802
Family Asilidae Latreille, 1802
Subfamily Stichopogoninae Hardy, 1930
Stichopogon Loew, 1847

Stichopogon Loew, 1847: 499
Type species: *Dasypogon elegantulus* Wiedemann *in* Meigen, 1820; by designation of BACK (1909: 332).

Stichopogon ariasi sp. nov.
Figs. 1a, 2a, 2c, 2e, 3a, 4-9
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Diagnosis: A slender and smallish grey species; antennae black; mystax white in both sexes; thorax with greyish tomentum and white bristles; legs black, covered with dense pale grey tomentum; abdomen black, tergites 1, 4, 5 with extensive pale grey tomentum forming broadly triangular marks. The last tergite always pale grey dusted in both sexes, while the two preceding segments are entirely black.

Type material of *Stichopogon ariasi* sp. nov.

Holotype: SPAIN: TOLEDO: Talavera la Nueva, 39.92°N 4.86°W, 355 masl, 23-V-2017, 1 ♂, leg. P. Álvarez Fidalgo [Col. MNCN reference nr. MNCN_Ent 234086].

Paratypes: SPAIN: MADRID: El Pardo, 40.5°N 3.7°W, 600 masl, 11-VI-1905, 2 ♂ + 4 ♀, leg. J. Arias Encobet [Col. MNCN, reference nr. MNCN_Ent 158030 (♂), MNCN_Ent 158032 (♂), MNCN_Ent 150081 (♀), MNCN_Ent 150082 (♀), MNCN_Ent 158033 (♀), and MNCN_Ent 158035 (♀)]; 17-VI-1906, 1 ♂ + 1 ♀, leg. J. Arias Encobet [Col. MNCN, reference nr. MNCN_Ent 158031 (♂) and MNCN_Ent 150083 (♀)]; 22-VI-1906, 1 ♂, leg. J. Arias Encobet [Col. MNCN, reference nr. MNCN_Ent 158034]; MADRID: Torrejón de Ardoz, 40.4°N 3.4°W, 550 masl, 27-V-1962, 1 ♀, leg. S. V. Peris [Col UCME, reference nr. 36820 UCME]; MADRID: Villafranca del Castillo, 40.45°N 3.94°W, 600 masl, 3-VI-2015, 1 ♂ (genitalia dissected), leg. P. Álvarez Fidalgo [Col. MNCN, reference nr. MNCN_Ent 234087]; 12-VI-2018, 1 ♂ + 1 ♀, leg. P. Álvarez Fidalgo [Col. MNCN, reference nr. MNCN_Ent 231294 (♂) and MNCN_Ent 231295 (♀)];

MADRID: Aldea del Fresno, 40.32°N 4.20°W, 460 masl, 20-V-2018, 1 ♂ + 1 ♀, leg. J. I. Pascual [Col. PAF]; TOLEDO: Talavera La Nueva, 39.92°N 4.86°W, 355 masl, 5-VI-2016, 2 ♂ + 3 ♀, leg. P. Álvarez Fidalgo [Col. RVDB]; 23-V-2017, 1 ♀, leg. P. Álvarez Fidalgo [Col. MNCN, reference nr. MNCN_Ent 234088].

Fig. 4: *Stichopogon ariasi* sp. nov. Copula in their natural habitat, Villafranca del Castillo, Madrid, 10-V-2015, (ÁLVAREZ, 2016b).
https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img847579.html

Etymology: The species is named after José Arias Encobet, who collected the first specimens known of the new species, back at the beginning of XX Century.

Description of *Stichopogon ariasi* sp. nov.

Male (Figs. 1a, 2c, 2e, 4-7)**:**

- **Size:** Length 6.3 mm, wing length 4.5 mm.

- **Head:** Black, with face below the antennae covered with dense pure white tomentum, frons up to the occiput and back of the head greyish black because of very thin and scarce whitish tomentum. Frons covered with sparse soft longish white hairs. Ocellar tubercle without real bristles, but some fine hairs are present. Occiput with 14-16 white postocular bristles. Lower occipital hair white. Facial gibbosity somehow squarish, occupying slightly less than half the distance below the antennae. Mystax consists of several rows of snow-white silky bristles clinging together in the middle. Upper margin of mystax softly triangular in frontal view. Palpi and proboscis black with sparse white hairs.

  Antennae black, inserted toward the middle of the height of the eyes and covered with sparse pale grey tomentum, denser on the postpedicel. Scape short with long white hairs on the lower part. Pedicel only very slightly longer than scape, as long as high, with a few erect hairs dorsally and

ventrally. Postpedicel laterally flattened, clearly longer than the two basal segments together and with a few very short bristly hairs dorsally on the apex. Stylum short and pointed, about half as long as the third antennal segment.

Fig. 5: *Stichopogon ariasi* sp. nov. Male with prey (*Hilara* sp.) in its natural habitat, Villafranca del Castillo, Madrid, 15-V-2014, (ÁLVAREZ, 2016a).
http://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img847578.html

- **Thorax:** Ground colour black but covered with rather sparse greyish tomentum, a little denser and more silvery grey on the prescutellar area. Presutural area of scutum without bristles, covered with short and mainly adpressed white pubescence. Postsutural area with the same kind of pubescence, very scarce and sparse thin dorsocentral hairs placed near the prescutellar area. Only three pairs of bristles on the scutum, all white: one notopleural, one supra-alar and one long post-alar. Scutellum black, covered with dense silvery grey tomentum, which gives it a whitish appearance. Discal scutellar hairs white, very sparse and short. Marginal area with several thin hairs of variable length. Pleura black, covered with dense white tomentum. Several antepronotal and proepisternal hairs present. A few whitish hairs on the frontal, ventral and posterior part of Anepisternum, and on posterior part of Katespisternum. Anepimeron completely bare. Bristles absent on pleura but for a row of 11-12 long white katatergal hair-like bristles. Halters with bright yellow lobe and brown stem.

- **Legs:** Coxae and legs black in the background but entirely covered with dense pale grey tomentum, which gives a whitish or very pale grey appearance. Coxae bear several hairs, longer and denser on coxa 1. Femora covered with very short white hairs, with some much longer ones ventrally. One single short dorsal bristle located toward the apical area of femora 2 and 3. Tibiae with more numerous and stout long bristles. All bristles and the sparse short hairs whitish. Tarsomeres covered with short white hairs. First two tarsomeres of hind legs covered with golden hairs on the ventral

side. All tarsomeres bear longish black and white bristles. Claws black. Pulvilli present, yellowish-brown coloured.

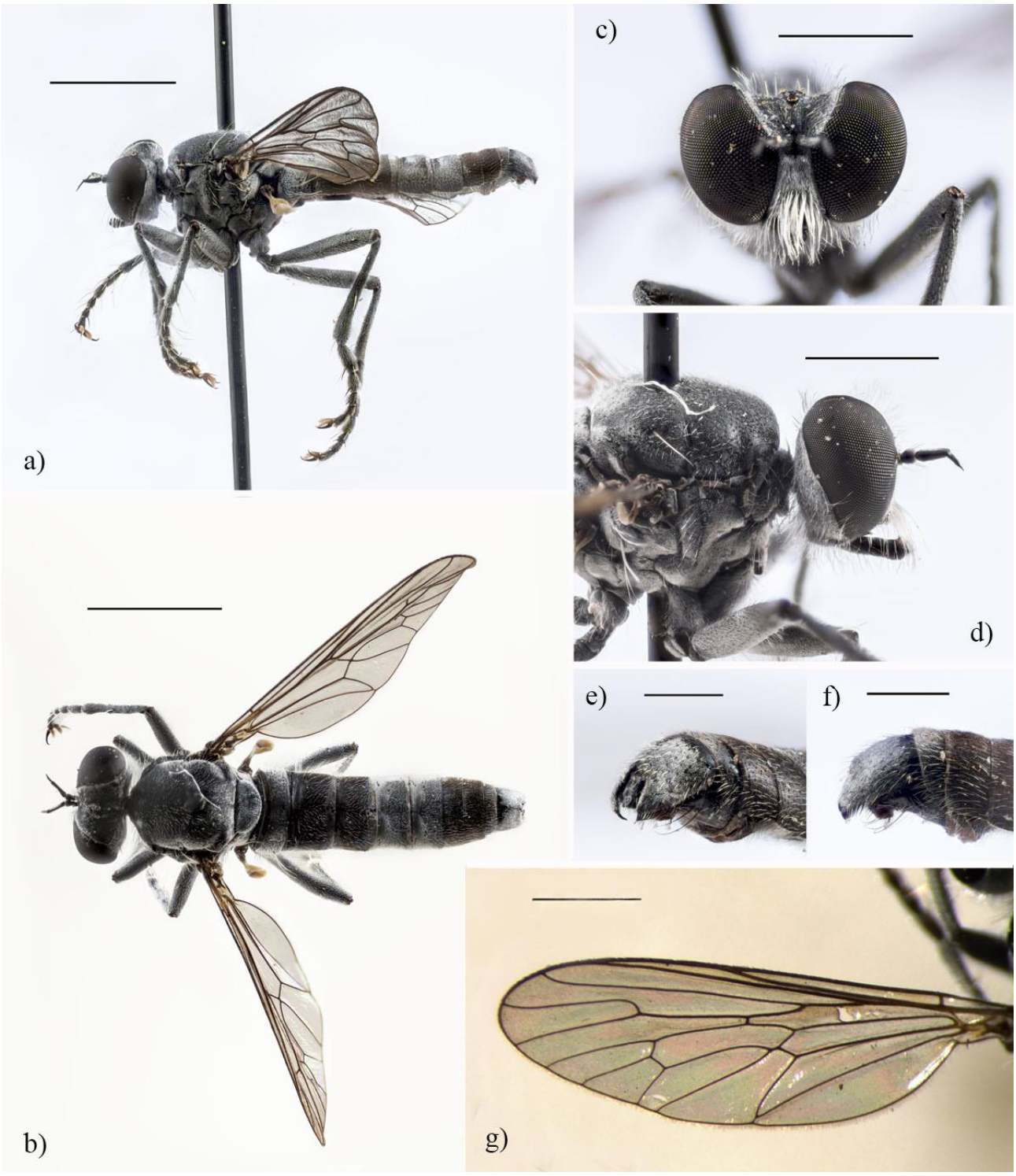

Fig. 6: *Stichopogon ariasi* sp. nov. Male holotype (MNCN_Ent 234086): a-f; a) habitus, lateral (scale bar = 2 mm); b) habitus, dorsal (scale bar = 2 mm); c) head, frontal view (scale bar = 1 mm); d) head, lateral view (scale bar = 1 mm); e) last tergite in postero-dorso-lateral view (scale bar = 0.5 mm); f) last tergite and sternite in lateral view (scale bar = 0.5 mm) (Photos: Alberto Narro Martín). Male paratype (MNCN_Ent 158032): g) wing (scale bar = 1 mm). (Photo: Piluca Álvarez Fidalgo)

- **Wing** (Fig. 6g)**:** Very faint grey, more hyaline toward the base. Black veins without any infuscation. Cells m1, m2 and m3 open. Anal cell petiolated. Alula very small. Microtrichia present all over.

- **Abdomen:** Tergites black with denser pale tomentum on tergites 1, 4, 5, and 9, which gives a banded appearance. Tergite 1 covered with dense pale grey tomentum on the sides, much less dense on the central area. Long white hairs on the sides, particularly in the posterior margin of the tergite, the central area covered with short and sparse hairs. Tergites 2 and 3 without tomentum but for the basal lateral side. Pubescence and hairs similar to first tergite but lateral hairs clearly shorter. Tergites 4 and 5 with pale grey tomentum forming broadly triangular marks, pubescence much shorter and sparse than on tergites 1-3 and lateral hairs even shorter. Tergites 6-8 with a very thin and sparse pale tomentum that does not cover the ground (tomentum a bit more developed on posterior margin of tergite 8) and pubescence short and adpressed, a bit longer and thicker on tergite 8. Tergite 9 covered with dense pale grey tomentum and thin pubescence. Sternites black, covered with very thin pale grey tomentum, much denser on sternite 1 and almost nonexistent on sternite 2. All sternites covered with short white hairs, much longer on sternite 1. Sternite 3 with a few adpressed bristle-like white hairs, denser and thicker on sternite 4. These bristle-like hairs become well-developed bristles on sternites 5-7 and are placed on the lateral parts and bent toward the center of the sternites.

- **Male terminalia** (Fig. 7)**:** The large epandrium is covered with silvery-grey tomentum and white hairs; it is shallow in the middle, with long basal and apical processes, the last ones bearing lateral rows of spines. Gonocoxyte and gonostylum black, with weak black bristles. Aedeagus similar to other species of the genus *Stichopogon*: simple, conical and end-curved.

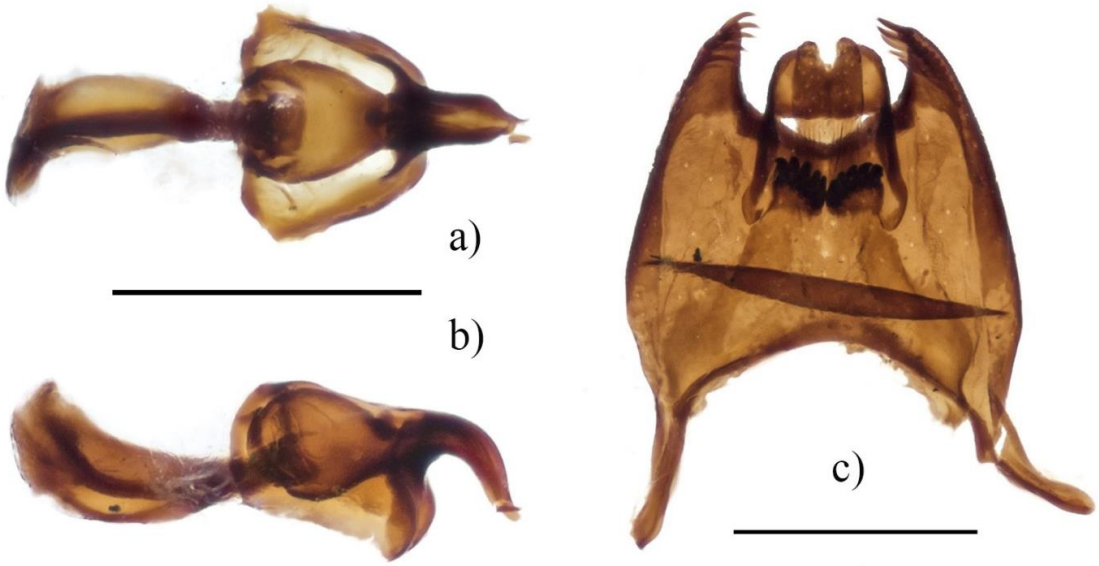

Fig. 7: Genitalia of *Stichopogon ariasi* sp. nov., male paratype (MNCN_Ent 234087) (scale bar = 0.5 mm): a) Aedeagus, dorsal view; b) Aedeagus, lateral view; c) Epandrium with proctiger. (Photos: Alberto Narro Martín)

Female (Figs. 2a, 3a, 4, 8, 9)**:**

Similar to male but slightly larger in size. Females tend to have more tomentum on the margins of tergites 2-3 than males. Abdominal pattern like male but it is the tergite 8 that is completely covered with pale grey tomentum and tergites 6 and 7 that are completely black. Tergites 6 and 7 with thicker and longer pubescence than males, which is black instead of white, more erect, and mainly directed backwards. True bristles completely absent on sternites; only real hairs present. Tergites 8 and 9 form ovipositor; each acanthophorite bears four blunt spines. The posterior part of the last sternite with long yellow-white hairs set thickly together and curved inwards at the apex.

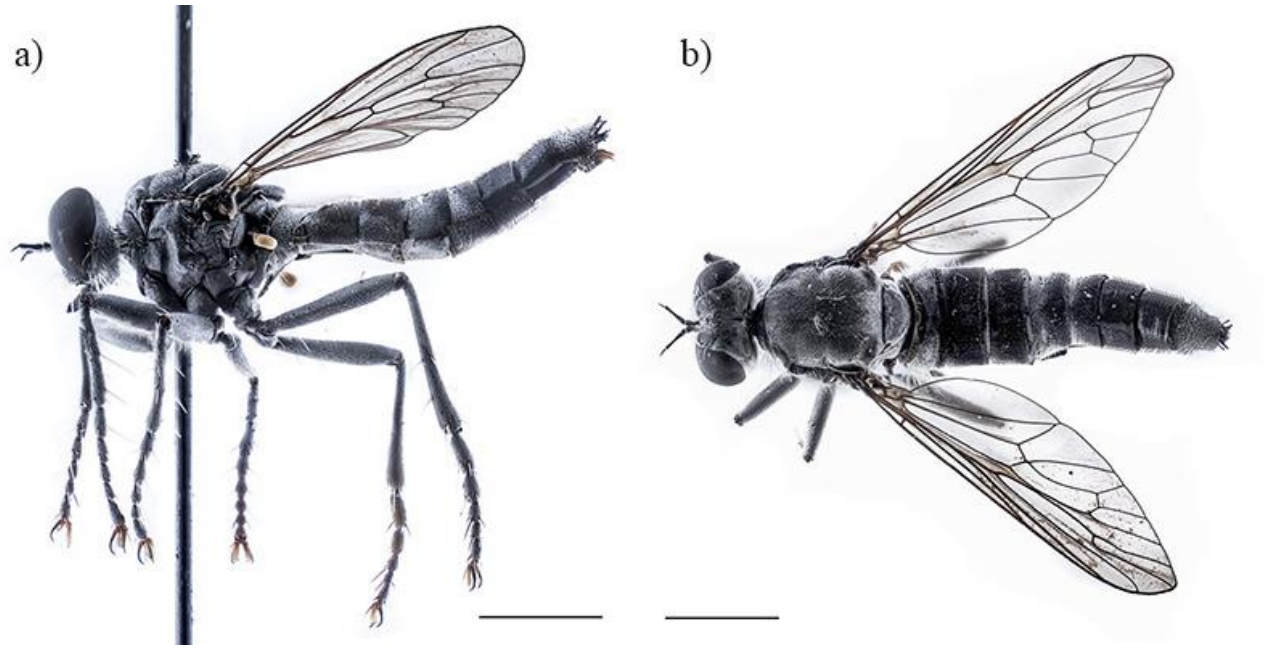

Fig. 8: *Stichopogon ariasi* sp. nov. Female paratype (MNCN_Ent 231295) (scale bar = 2 mm): a) habitus, lateral view; b) habitus, dorsal view. (Photos: Alberto Narro Martín)

Fig. 9: *Stichopogon ariasi* sp. nov. Female with prey (*Empis* sp.) in its natural habitat, El Pardo, Madrid, 7-V-2015, (ÁLVAREZ, 2015).
https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img767939.html

Variation: Variation noted mainly involves colouration changes due to loss of tomentum. Also the length of hairs on the sides of tergites can be variable. It must be noticed that the eyes are bright purplish-blue coloured in living specimens. This colour is lost when the specimens die, and becomes brownish.

Behaviour: Most, if not all, *Stichopogon* species are ground dwelling. The behaviour of *S. ariasi* seems to confirm a terrestrial existence. All specimens observed by the first author since her first encounter were sitting and mating on the ground (Fig. 4). However, a picture exists of a copula in the vegetation (BATTLE, 2012). This may well be a result of disturbance. It is well known that many ground dwelling asilids flee into the vegetation when disturbed.

Not much is known about the early stages or the laying of eggs by *Stichopogon* species, but as the ovipositor is equipped with acanthophorites that are armed with spines, it can be safely assumed that eggs are deposited in the sandy soil. The deposition of eggs by *S. ariasi* has not been observed yet.

Stichopogon species take their prey mostly in the air but also on the ground. Prey seems to consist mainly of Diptera and Hemiptera, but also spiders and other small arthropods (BARNES, 2013). *S. ariasi* has only been observed to capture Empids. It has been photographed with captured *Hilara* (Fig. 5) and *Empis* species (Fig. 9). However, due to the limited observations of hunting behavior, it wouldn't be surprising if prey is more variable.

Habitat: *Stichopogon* species can be found along sandy shores and riverbanks (EFFLATOUN BEY, 1937; MUSSO, 1978). Based on the collecting sites, *S. ariasi* seems to be associated with sandy or dusty paths near water in areas surrounded by Mediterranean vegetation (mainly *Quercus ilex* L. and *Retama* sp.) and riverine trees (*Fraxinus angustifolia* Vahl, *Populus* sp.) (Fig. 10). Such habitat is consistent with what is known about all *Stichopogon* species, which are very thermo- and psammophilous and prefer warm sandy areas, which may be more or less humid. The degree of humidity may be of relevance to the development of the larvae (BARNES, 2013).

Fig. 10: Two views of typical habitat of *Stichopogon ariasi* sp. nov.: a) El Pardo (Madrid). (Photo: Piluca Álvarez Fidalgo); b) Villafranca del Castillo (Madrid). (Photo: Marián Álvarez Fidalgo)

Distribution: Up to this date, the species is only known from the provinces of Madrid and Toledo. Apart from the pinned specimens shown in Table 1, more records of specimens photographed in the wild are available on the web site BiodiversidadVirtual.org (BIODIVERSIDAD VIRTUAL, 2019). *S. ariasi* was photographed in its natural habitat for the first time in Talavera La Nueva (province of Toledo) in 2012 (BATLLE, 2012). All photographic records are shown in chronological order in Table 3:

Observer	Record date	Nr. and sex	Location	Province	UTM
BATLLE, R. M. (2012)	10-V-2012	1♂+1♀	Talavera la Nueva	Toledo	30SUK32
BATLLE, R. M. (2016)	11-V-2012	1♂	Talavera la Nueva	Madrid	30SUK32

ÁLVAREZ, P. (2013)	2-VI-2013	1♀	Fresno de Torote	Madrid	30TVK69
ÁLVAREZ, P. (2014)	15-V-2014	1♀	Villafranca del Castillo	Madrid	30TVK17
ÁLVAREZ, P. (2016a)	15-V-2014	1♂	Villafranca del Castillo	Madrid	30TVK17
ÁLVAREZ, P. (2015)	7-V-2015	1♀	El Pardo	Madrid	30TVK38
ÁLVAREZ, P. (2016b)	10-V-2015	1♂+1♀	Villafranca del Castillo	Madrid	30TVK17
ÁLVAREZ, P. (2017)	5-VI-2016	1♂+1♀	Talavera la Nueva	Toledo	30SUK32
ÁLVAREZ, M. (2018)	22-V-2017	1♂+1♀	Villafranca del Castillo	Madrid	30TVK17

Table 3: Data compilation of living specimens of *Stichopogon ariasi* sp. nov., identified from photographs available in the public website BiodiversidadVirtual.org.

The maps of Fig. 11 show the UTM coordinates of all the locations where the specimens of *S. ariasi* were collected and where the photographs were taken.

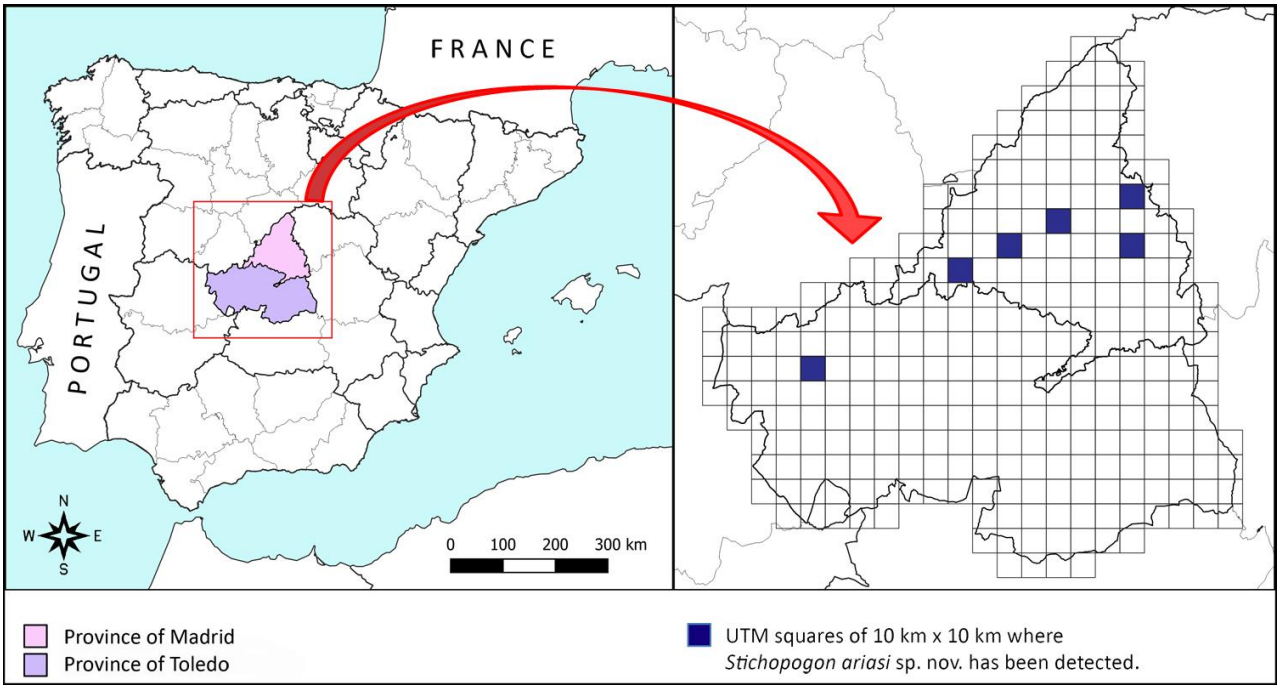

Fig. 11: Distribution map of *Stichopogon ariasi* sp. nov. on the Iberian Peninsula, created from collected specimens and photographic records. All records available are featured in a 10 km × 10 km grid map of the provinces of Madrid and Toledo.

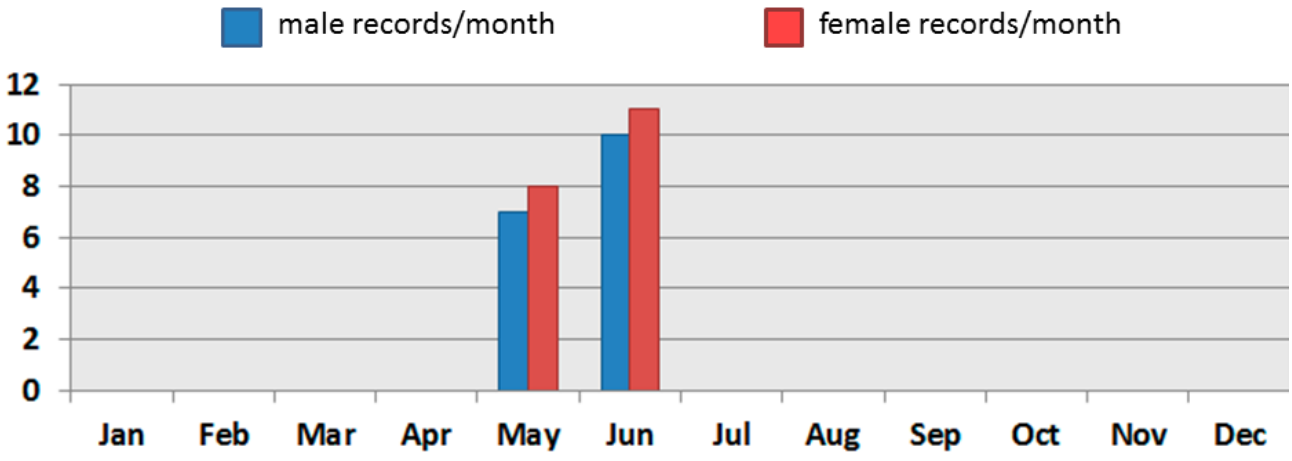

Fig. 12: Graphic showing the flight period of *Stichopogon ariasi* sp. nov., based on the 36 records gathered from collections and photographs.

Phenology: The flight period of *S. ariasi* lasts from early May to late June as can be deduced from the available information (Tables 1 and 3). A tentative conclusion, due to the limited observations, may be that *S. ariasi* is a spring and early summer species (Fig. 12).

Key to the identification of the species of *Stichopogon* cited on the Iberian Peninsula

A key for the species of *Stichopogon* recorded on the Iberian Peninsula has never been published. We present a provisional key that covers all species of *Stichopogon* recorded on the Iberian Peninsula up to this date. It is largely based in BEZZI (1910) and ENGEL (1930), although some modifications were needed.

1(a) Both femora and tibiae black, covered with grey tomentum ……..…... 2
1(b) All femora dark, tibiae and tarsi reddish yellow, only apical parts black ……...… 5

2(a) All tergites of abdomen with more or less narrow bands of pale tomentum. Mystax of male black, of female white ……..……...……..…...…...….. ***S. schineri*** Koch, 1872
2(b) Only some tergites with a band of pale tomentum ……...…… 3

3(a) Frons, most of mesonotum and abdomen shiny black; tergites 4-5 with bands of thin white tomentum along front margins. Face very narrow; mystax pale in both sexes (white in male, yellowish in female) ….....
…….....……..….... ***S. pusio*** (Macquart, 1849)
3(b) Frons, most of mesonotum and abdomen at least partially tomentose; tergites 1, 4, 5 and 8 (in female) or 9 (in male; dorsal side of hypopygium) with extensive greyish white tomentum ……..…… 4

4(a) Thoracic bristles black; mystax black in both sexes, consisting of several rows of protruding bristles
……..……..... ***S. albofasciatus*** (Meigen, 1820)
4(b) Thoracic bristles white; mystax white in both sexes, consisting of several downward-bent hair-like bristles clinging together in the middle ……..……...…..… ***S. ariasi*** sp. nov.

5(a) Antenna reddish-yellow to reddish-brown; setae on first abdominal tergite thick; tergites yellowish-white pollinose ……..... ***S. scaliger*** Loew, 1847
5(b) Antennae black; setae on first abdominal tergite more hair-like; tergites grey-pollinose ……...……. 6

6(a) All tergites with a similar pattern of pale tomentum forming a band ……...…….…...
……...……...…. ***S. elegantulus*** (Wiedemann *in* Meigen, 1820)
6(b) Tergites 3, 6 and 7 completely shiny black, the rest with bands of pale tomentum of different width
…..…… ***S. inaequalis*** Loew, 1847

Discussion

Our study of the genitalia of all species involved was limited because no material for dissection was available for *S. albofasciatus* and *S. beckeri*. We could not study their type material, either.

However the specimen of *S. beckeri* used for this study was collected in Egypt (type locality) and is consistent with the description given by ENGEL (1930), who did study the type material. Moreover, the recent revision of the genus in Egypt (ABU EL-HASSAN *et al*., 2017) provides an updated key for all the species recorded in Egypt, and the specimen from MNB keys out without any doubt to *S. beckeri*. The authors consider this specimen reliable for comparison.

Something similar happened with the specimens of *S. albofasciatus* that were used as comparative material. The three specimens from central Europe present in MNCN were collected in Austria, which happens to be the country of the type locality. The information provided in WEINBERG & BÄCHLI (1995) confirmed that the studied specimens from Austria are indeed *S. albofasciatus*. THEODOR (1976) illustrated the genitalia of this species, which allowed us to compare them with those of the new species. In spite of certain general similarities, the differences are also clear, as was commented previously.

Conclusions

This study shows once more that the family Asilidae on the Iberian Peninsula has been extremely neglected for many years and that there is a huge amount of work to do, even with supposedly well-known species from Central Europe, which have been recorded for many years in this territory.

In our opinion the subfamily Stichopogoninae still needs a thorough study within this large area. More studies are being carried out at the moment that hopefully will help to clarify some aspects of its obscure taxonomy.

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References

ABU EL-HASSAN, G. M. M., BADRAWY, H. B. M., GAD ALLAH, S. M., SOLIMAN, A. M., SALAMA, M. S. & MOHAMMAD, S. K. (2017). Review of robber flies of the genus *Stichopogon* Loew (Diptera: Asilidae: Stichopogoninae) from Egypt. *Zootaxa*, **4242** (1): 142-160.

ÁLVAREZ, M. (2018). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img962181.html. [Accessed on 15-III-2019].

ÁLVAREZ, P. (2013). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img469858.html. [Accessed on 15-III-2019].

ÁLVAREZ, P. (2014). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img606270.html. [Accessed on 15-III-2019].

ÁLVAREZ, P. (2015). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img767939.html. [Accessed on 15-III-2019].

ÁLVAREZ, P. (2016a). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: http://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img847578.html. [Accessed on 15-III-2019].

ÁLVAREZ, P. (2016b). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found

on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img847579.html. [Accessed on 15-III-2019].

ÁLVAREZ, P. (2017). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img924366.html. [Accessed on 15-III-2019].

ÁLVAREZ FIDALGO, P. & VAN DEN BROEK, R. (2019). Checklist de Fauna Ibérica. Familia Asilidae (Arthropoda: Insecta: Diptera) en la península ibérica e islas Baleares (edición 2019). In: RAMOS, M. A. & SÁNCHEZ RUIZ, M. (eds.): *Documentos Fauna Ibérica, **9***. Madrid. Museo Nacional de Ciencias Naturales. Consejo Superior de Investigaciones Científicas. [2] + 16 pp.

BACK, E. A. (1909). The Robber-flies of America, north of Mexico, belonging to the Subfamilies Leptogastrinae and Dasypogoninae. *Transactions of the American Entomological Society*, **XXXV** (1): 137-400.

BARNES, J. K. (2013). The Genus *Stichopogon* Loew (Diptera: Asilidae) in America North of Mexico. *Proceedings of the Entomological Society of Washington*, **115** (1): 9-36.

BATLLE, R. M. (2012). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img339652.html. [Accessed on 15-III-2019].

BATLLE, R. M. (2016). *Stichopogon ariasi* Álvarez Fidalgo & van den Broek, 2019. Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Stichopogon-ariasi-Álvarez-Fidalgo-&-van-den-Broek-2019-img809940.html. [Accessed on 15-III-2019].

BEZZI, M. (1910). Revisio systematica generis Dipterorum Stichopogon. *Annales historico-naturales Musei nationalis hungarici*, **VIII**: 129-159.

BIODIVERSIDAD VIRTUAL (2019). Online database. Available from: https://www.biodiversidadvirtual.org. [Accessed on 23-II-2019].

BOSÁK, J., HRADSKÝ, M., SCHMID-EGGER, C., BÁBKOVÁ HROCHOVÁ, M. (2014). Order Diptera, family Asilidae. Further records and an overview of the family Asilidae in the UAE. In: VAN HARTEN, A. (ed.): *Arthropod Fauna of the UAE. Volume **5***. Abu Dhabi. Department of the President's Affairs. 744 pp.

CARLES-TOLRÁ, M. (2018). Novedades faunísticas de asílidos de España, Portugal y Andorra (Diptera: Asilidae). *Boletín de la Sociedad Entomológica Aragonesa (S.E.A.)*, **63**: 143-148.

DIKOW, T. (2009). Phylogeny of Asilidae inferred from morphological characters of imagines (Insecta: Diptera: Brachycera: Asiloidea). *Bulletin of the American Museum of Natural History*, **319**: 1-175.

EFFLATOUN BEY, H. C. (1937). *A Monograph of Egyptian Diptera. Part V. Family Asilidae. (Section II : Sub-families Dasypogoninae and Leptogastrinae)*. Mémoires de la Société royale entomologique d'Égypte. **4**me Volume – 3me Fascicule. Cairo. Faculty of Science. Egyptian University. 245 pp.

ENGEL, E. O. (1930). Asilidae. In: LINDNER, E. (ed.): *Die Fliegen der Palaearktischen Region*. *Band **IV** (2)*. Stuttgart. E. Schweizerbart'sche Verlagsbuchhandlung. 491 pp.

FREY, R. (1958). Zur Kenntnis der Diptera brachycera p.p. der Kapverdischen Inseln. *Societas Scientiarum Fennica. Commentationes Biologicae*, **XVIII** (4): 1-61.

GELLER-GRIMM, F. (2005). Robber Flies (Asilidae) [Online database]. Available from: http://www.geller-grimm.de/asilidae.htm. [Accessed on 23-II-2019].

HULL, F. M. (1962). *Robber Flies of the World. The Genera of the Family Asilidae*. Bulletin of the United States National Museum, **224** (Parts 1 + 2). Washington. Smithsonian Institution. United States National Museum. 907 pp.

MARSHALL, S. A. (2012). *Flies. The Natural History and Diversity of Diptera*. Buffalo. Firefly Books. 616 pp.

MUSSO, J. J. (1978). *Recherches sur le devéloppement, la nutrition et l'écologie des Asilidae (Diptera – Brachycera)*. Thèse. Saint-Jérôme. Faculté des Sciences et Techniques. Université de Droit, d'Économie et des Sciences d'Aix-Marseille. 312 pp.

PORTILLO, M., SIERRA, M. E. & BÁEZ, M. (2002). Asilidae. In: CARLES-TOLRÁ HJORTH-ANDERSEN, M. (coord.): *Catálogo de los Diptera de España, Portugal y Andorra (Insecta)*. *Monografias S.E.A. Vol. **8***. Zaragoza. Sociedad Entomológica Aragonesa. 323 pp.

THEODOR, O. (1976). *On the Structure of the Spermathecae and Aedeagus in the Asilidae and their Importance in the Systematics of the Family*. Jerusalem. The Israel Academy of Sciences and Humanities. 175 pp.

WEINBERG, M. & BÄCHLI, G. (1995). Diptera. Asilidae. In: SCHWEIZERISCHE ENTOMOLOGISCHE GESELLSCHAFT (ed.): *Insecta Helvetica*. *Fauna*, ***11***. Geneva. Schweizerische Entomologische Gesellschaft. 124 pp.

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